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China Rethinks Its Nuclear Submarine Program [redacted]

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A Research Paper

DIA review completed.

NAVY, NGA Reviews Completed

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NAVY Review Completed

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This paper was written by
Office of East Asian Analysis. Comments and queries are welcome and may be addressed to the Chief, China Division, OEA,

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China Rethinks Its Nuclear Submarine Program [redacted] 25X1

NAVY Review Completed

Summary

Information available as of 7 December 1984 was used in this report.

After an expensive, 25-year-long program, the Chinese apparently have decided to discontinue construction of nuclear submarines in favor of modernizing their large diesel-powered submarine force. Although the reasons for the apparent decision are unclear, we believe Chinese leaders are satisfied they have realized the prestige value of developing nuclear submarines and see an improved diesel-powered submarine force as a more cost-effective response to the growing Soviet naval presence in the Pacific. [redacted] 25X1

Only the fifth country to develop and produce nuclear-powered submarines, China has built three Han-class nuclear-powered attack submarines (SSNs) and one Xia-class nuclear-powered ballistic missile submarine (SSBN). Activity at Huludao shipyard indicates that one or two SSNs—or possibly an SSN and an SSBN—are under construction. If so, we expect them to be completed. [redacted] 25X1

The small number of China's nuclear submarines and their technological weaknesses limit Beijing's deployment options. When operational in 1986 or 1987, the Xia will probably make irregular patrols in Chinese waters, and we expect it would deploy to the Bohai Gulf or Yellow Sea during any period of prolonged crisis with the Soviet Union. The 2,400-kilometer range of the CSS-NX-3 submarine-launched ballistic missile and restricted operation of the Xia, however, would limit the SLBM to targets in the Soviet Far East. [redacted] 25X1

Even though the Chinese have apparently decided to cease production of the current generation of nuclear submarines, they will probably continue to invest in research and development in order to design a bigger, more capable SSBN that could carry a longer range missile. [redacted] 25X1

For the next five to 10 years China will focus on the acquisition of advanced foreign technologies—especially from the United States. In addition, we expect the Chinese to apply any technology they acquire for their diesel-powered submarines to the nuclear submarine program. In any event, deployment of a new nuclear submarine system is unlikely for the rest of this century. [redacted]

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China Rethinks Its Nuclear Submarine Program

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China's Nuclear Submarine Force: A New Direction

Over the past 30 years, China's perception of external threats and plans to build a credible nuclear force to deter such threats have been substantially revised. In the mid-1960s, when Beijing began committing extensive resources to the development of a ballistic missile submarine, China considered the nuclear threats from the United States and the Soviet Union to be equal.

25X1 both the Xia and the CSS-4 ICBM were originally intended to threaten the US mainland.

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In the late 1960s, China's leaders became more concerned about a preemptive Soviet nuclear strike that could destroy China's ability to retaliate. As a short-term approach to the problem of vulnerability,

25X1 25X1 emphasized the mobility of its shorter range ballistic missiles. It also continued to develop nuclear-powered submarines and a solid-propellant submarine-launched ballistic missile (SLBM).

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The Chinese apparently now believe, however, that the deployment of only a small force of current-generation nuclear submarines will not add enough to China's nuclear deterrence to justify the high cost of continuing the program. According to a contact of the US defense attache in Beijing, China plans to halt construction of nuclear submarines and use its limited resources to improve its large diesel-powered submarine force with advanced naval technology obtained from the West. The source said production facilities would be maintained so that new construction could be started if necessary. We believe that two nuclear submarines now under construction will also be completed.

Other reporting supports the source's claim that a 25X1 decision has been made to halt construction. Earlier reports from the defense attache had suggested a debate was under way in the military leadership over the best response to the Soviet submarine threat in waters off the Chinese mainland and that proponents of nuclear propulsion systems were losing support. In

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A Small Force With Technological Weaknesses

If the Chinese stop production, they will be left with a force of four or five Han-class nuclear attack submarines (SSNs) and one or two Xia-class nuclear-powered ballistic missile submarines (SSBNs). Until recent months, 25X1 the Chinese planned to build five SSBNs. 25X1 25X1

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most analysts believe one or two SSNs are being built. It is also possible, however, that an SSBN and an SSN are under construction. 25X1

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China's nuclear-powered submarines have a number of weaknesses that limit their operational utility:

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- *Propulsion.* China's nuclear submarines are relatively slow and more vulnerable to detection and attack.

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- *Fire Control.* China's submarines almost certainly do not have modern combat information and action centers. Torpedo fire-control data are probably manually entered into a rudimentary display, increasing reaction time and limiting the submarine's combat effectiveness.

- *Contamination.* China's nuclear submarines may give off unacceptably high levels of radiation. A Chinese naval officer on a visit to a US nuclear submarine base in April expressed surprise that we did not appear to be concerned about radiation levels in and around our submarines. He implied that Chinese crewmen experienced severe health problems caused by radiation emitted from their nuclear submarines.

Deployment Options

The limited numbers and capabilities of China's nuclear submarines restrict Beijing's options for their deployment. We believe China's nuclear submarines would not now play a significant role in any conflict with the Soviet Union, because of the high risk of detection and the limited range of the CSS-NX-3.

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The Xia. Unless or until the Chinese build additional SSBNs, they will probably limit the Xia to patrols in waters near China. A fleet of three SSBNs would be needed to maintain regular patrols, and as many as five might be needed to keep one permanently on station in distant waters.

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During extreme tension with the Soviet Union, we expect China to deploy the Xia to one of a number of preselected areas in the Bohai Gulf or Yellow Sea:

- Short transit time to a missile launch area would allow the Xia to arrive on station quickly and remain on station for long periods.
- Chinese air and naval bases in North China would give the Xia greater protection from antisubmarine warfare (ASW) forces.
- Closeness to the Chinese mainland would allow the full use of China's communications network, making it easier for Beijing to maintain command and control over the Xia.
- Short patrols would reduce maintenance, during which the Xia would be unavailable for operations.

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Only a few Soviet cities are, however, within striking distance of the CSS-NX-3 launched from northern Chinese waters (see figure 5). These targets are well within the range of China's land-based medium- and intermediate-range ballistic missiles, some of which would probably survive a Soviet first strike on China's nuclear forces.

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China could deploy the Xia to the Western Pacific just east of the Japanese Islands where deep water would help it hide from hostile naval forces. The risk of detection in transit would be great, however, and the Xia would still be a threat to only a few Soviet cities.

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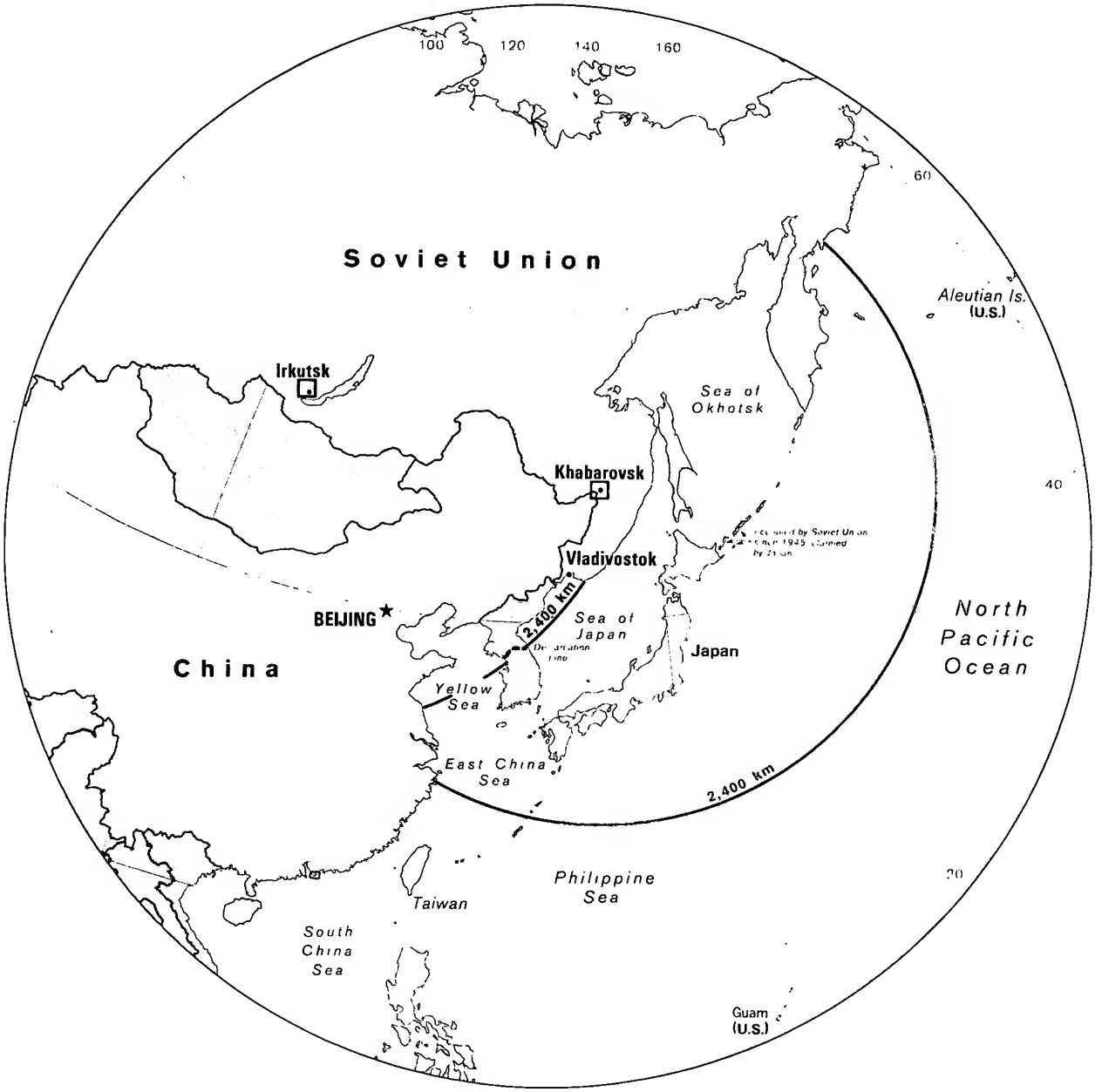
Figure 5
Xia Deployment Areas Within Striking Range of Major Targets in the Soviet Far East



[redacted]

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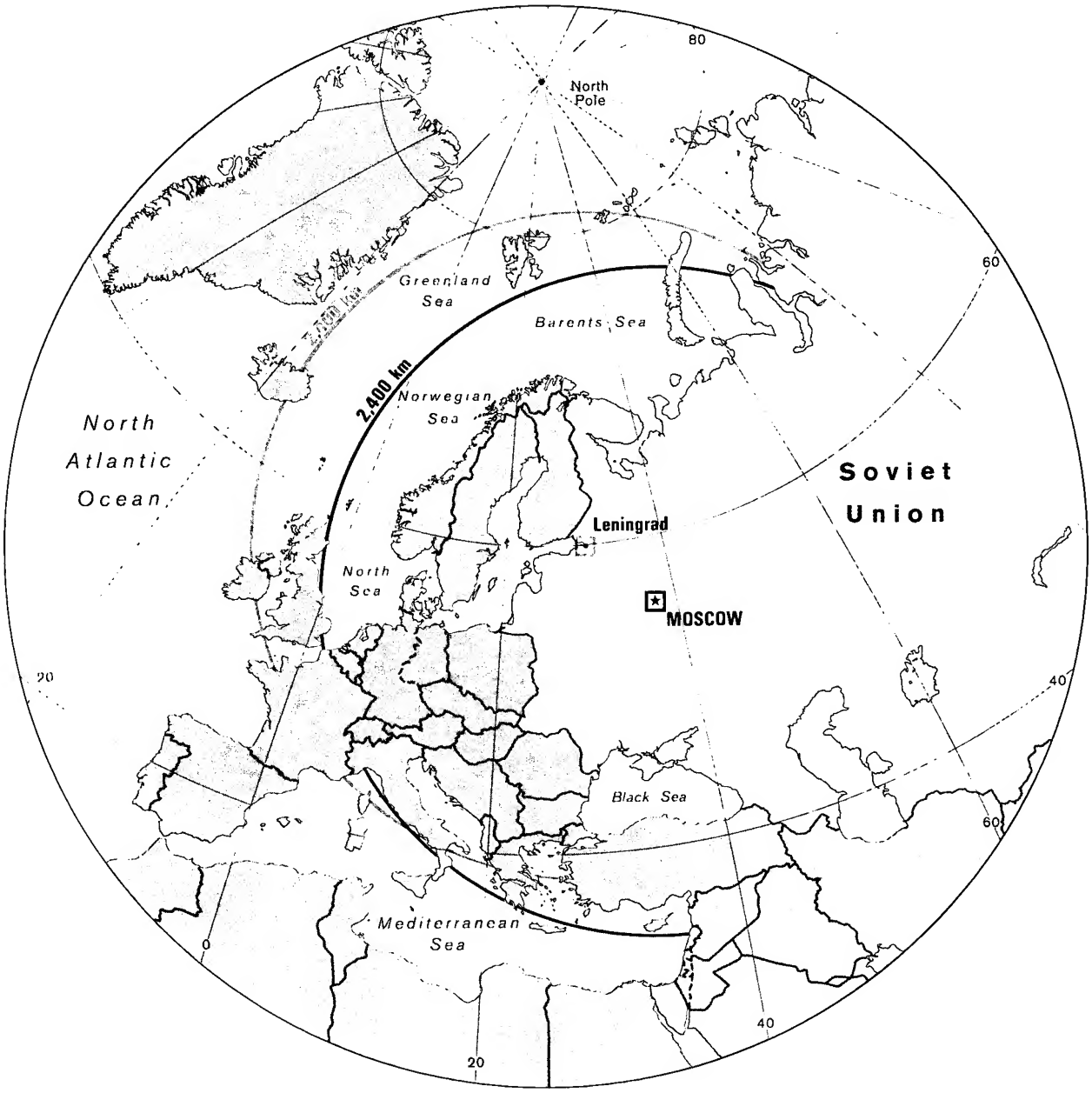
Figure 6
Xia Deployment Areas Within Striking Range of Moscow and Leningrad



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Command and Control of Nuclear Weapons

We believe the Military Commission of the Chinese Communist Party exercises direct control over all Chinese nuclear weapons and is the only body able to authorize their use in a war. We expect strict control at the highest levels of authority to extend to nuclear weapons deployed on submarines in the future.

Naval Headquarters in Beijing almost certainly commands all of China's nuclear-powered submarines, but day-to-day administration is probably exercised by the Commander of the North Sea Fleet. The Xia currently operates with units of the North Sea Fleet 25X1 *We believe it will continue to be administered by the North Sea Fleet when it begins operational deployment sometime in the next two or three years.* 25X1

25X1 *nuclear submariners constitute a distinctive career service. We expect the Military Commission eventually to form a centralized nuclear submarine command with authority over the Xia, any other SSBNs, and Han-class SSNs.*

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Chinese naval leaders have told the US defense attache in Beijing that they want to conduct SSBN patrols in the Sea of Japan. We believe, however, it is highly unlikely that the Chinese would conduct blue-water patrols unless they had two or three SSBNs. If only one Xia is operational, such patrols would expose the Xia to a greater risk of accident in an area where rescue operations would have little chance of success. Moreover, given the Xia's probable slow speed, lack of sophisticated electronics, and high noise level, the Chinese may not wish to send it into waters where Soviet and US ASW forces could monitor it. 25X1 25X1

To threaten Moscow, Beijing would have to send the Xia into the Mediterranean or the North Atlantic (see figure 6). The transit time to these areas is considerable, and the chances of the Xia arriving on station undetected are minimal. Moreover, maintaining command and control of the Xia over great distances—difficult in peacetime—would be nearly impossible during a war, 25X1

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The Han. Because of the Han's limited ASW capabilities, we believe it will be used primarily in defense of the Xia. Because of their close structural similarity with the Xia, the Hans could also serve as decoys for the SSBN, complicating Soviet ASW efforts. The Chinese would have to make significant improvements in the Han's electronics and weaponry, however, before they could function effectively as an ASW platform. 25X1

Han SSNs could also be used in an antishipping role. Given their superior submerged endurance over diesel-powered Romeo-class submarines, the Hans may be ordered to attack unescorted Soviet auxiliaries and interdict Soviet merchant shipping. China, however, probably would use Romeos, not Hans, to attack Soviet surface warships. The Romeos are more expendable and may be harder to detect in the relatively shallow water where Soviet warships are likely to be engaged. Diesel submarines can shut down their engines to reduce noise; nuclear submarines must keep reactor cooling pumps running at all times. 25X1

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Table 1
Han SSN and Romeo SS
Operational Characteristics

	Submerged Speed (*knots*)	Radius of Action (*nautical miles*)	Working Depth (*meters*)	Patrol Endurance (*days*)
Romeo SS	12.5	2,400	240	40
Han SSN	24	3,600	280	60

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Options for the Future

In spite of all the problems China has had with the program, nuclear submarines do have advantages that will continue to make them attractive. The deployment of the Xia will add 12 missiles to the 100-odd medium-range and intermediate-range land-based launchers that can strike targets in the Soviet Far East, and Beijing could use it to threaten US cities on the Pacific coast. China's SSNs also have a number of potential advantages over diesel-powered units. The high speed and submerged endurance of SSNs could give China a capability to interdict enemy shipping far from Chinese waters. If equipped with modern electronics and torpedoes, the SSNs could give the Chinese a more effective antisubmarine capability than they now have.

25X1 We believe these advantages, combined with Moscow's growing ability to find and destroy land-based missiles, will push the Chinese to continue investing in research and development on SLBMs and nuclear submarines.

25X1 ***A Longer Range Missile.*** The Chinese could modify the Xia to carry a slightly larger missile. With a larger missile, the possible development of more advanced propellants, and a lighter reentry vehicle, the Chinese might be able to deploy an SLBM with a range of about 3,600 km within the next five to 10 years. But a 3,600-km-range SLBM would still not allow a modified Xia to threaten the European USSR from relatively secure waters. Therefore, we believe the Chinese will opt for a completely new SSBN.

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A New SSBN. the Chinese have begun to design a new generation of SSBNs. Such an SSBN would be much bigger than the Xia and might be designed to carry a three-stage missile similar to the French M-4, which has a range of 4,600 km. Even if they are developing a new SSBN and missile, the Chinese will probably not be able to deploy them for at least the next 15 years.

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A Modified Han. The Chinese will probably equip existing Hans with more modern weapons and electronics. In the more distant future, they may build a new SSN with increased speed and diving depth. Beijing may also decide to develop a nuclear-powered cruise missile submarine based on the Han design. China modified a Romeo-class diesel submarine in 1982-83 to carry six solid-propellant cruise missiles now under development. If this program is successful, we believe China may decide to build a nuclear-powered cruise missile submarine sometime in the future.

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One key decision China will have to make is whether to use two reactors to increase the speed and reliability of its nuclear submarines. The Soviet Union has put dual reactor systems on most of its nuclear-powered submarines. They gained speed, but at some sacrifice in quietness. In order to build quiet submarines, we believe China will choose to develop powerful, single-reactor systems similar to those on US and French submarines. Advanced technology from Western nuclear power plants being built in China will give the Chinese an advantage the Soviets did not have and may allow Beijing to develop better reactors for its submarines.

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A Continuing Need for Foreign Technology

Whatever China decides, it will continue to look upon the West—especially the United States—as a primary supplier of needed technology.

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Naval Technologies the Chinese Want

Over the next several years, we expect the Chinese to concentrate on the acquisition of certain key technologies:

- *Antisubmarine warfare:*
  - *Long-range passive sonars.*
  - *Towed-array sonars.*
  - *High-speed, wire- and optical-fiber-guided torpedoes.*
- *SLBMs:*
  - *Guidance systems.*
  - *High-energy solid propellants.*
  - *Production of filament-wound cases for rocket motors.*
- *Submarine design:*
  - *Noise-reduction methods.*
  - *Safe, more powerful reactors.*
  - *Special steels and advanced welding techniques.*

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In addition, we expect the Chinese to apply foreign technology acquired for the civilian nuclear power and steel industries, as well as military technology obtained to improve the diesel-powered submarine force, to their nuclear submarine research effort. In December 1983, China signed a contract to purchase French Fenelon passive sonars, ostensibly to be fitted on Romeo-class submarines. Some analysts believe these sonars are also destined for China's SSNs and SSBNs. According to a defense attache source, the Chinese also are negotiating with the Italians for an advanced antisubmarine torpedo which could be used on either diesel- or nuclear-powered submarines.

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Despite the apparent shift in emphasis from nuclear- to diesel-powered submarines, China's submarine fleet will remain the most effective arm of the Navy and, as such, will receive the bulk of naval modernization funding. Beijing will be able to modernize an existing fleet of 90-odd Romeo-class submarines, knowing that the technology acquired for the Romeos can later be applied to second-generation nuclear submarines.

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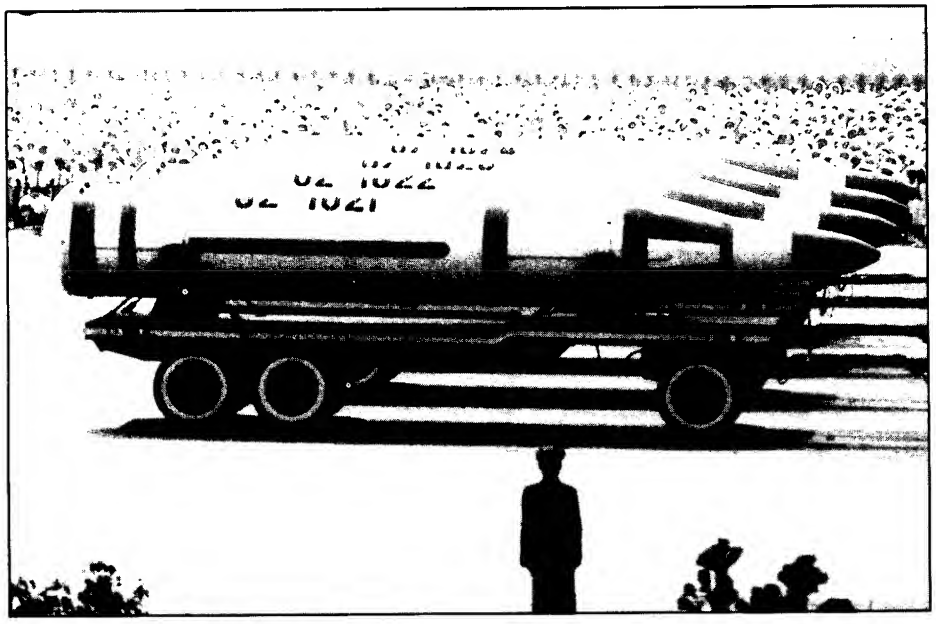
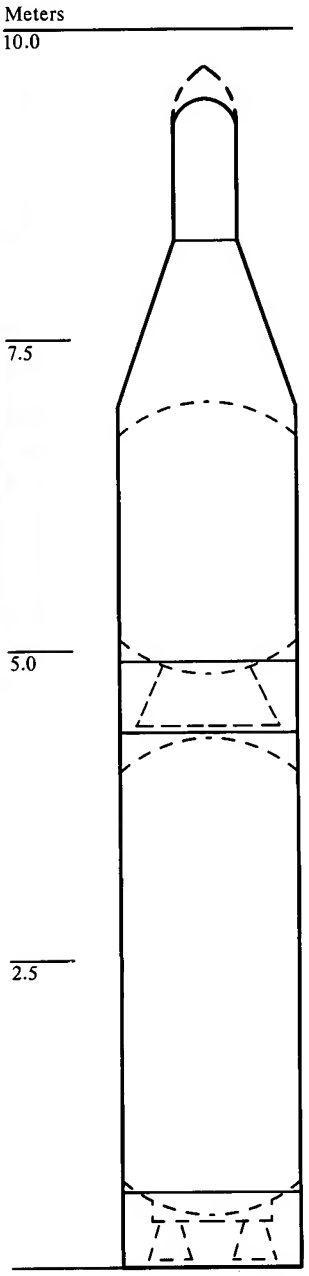
Figure 7
China: The CSS-NX-3 SLBM





Estimated Characteristics

Maximum Range	2,400 kilometers [1]
Warhead Yield	700 kilotons [1]
Circular Error Probable (at maximum range)	2 to 3.5 km
Propellent	Solid Composite 2 Stage
Chinese Name	Julang-1 (JL-1)

[1] Approximate.

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Appendix A

The CSS-NX-3 SLBM

Although designs of early Chinese ballistic missiles (the CSS-1, 2, and 3) were based on missiles and technology supplied by the Soviets in the late 1950s, designs of later missiles (the CSS-4 ICBM and CSS-NX-3 SLBM) were clearly influenced by Western technology. The CSS-NX-3 probably has steel motor cases and composite propellants similar to those used in the Polaris A2 and French M1/M2 SLBMs. The Chinese have attempted to acquire more advanced technology—including high-energy propellants and manufacturing equipment for filament-wound motor cases—but we do not know if they have been successful. In any case, we believe the Chinese will be unable to produce a missile system with such state-of-the-art technology for at least the next five years.

Table 2
Projected Chinese SLBM Force, 1984-94

Deployed System [a]	1984	1986	1988	1990	1994
SSBN	0	0-1	1-2	1-2	1-3
SLBM	0	0-12	12-24	12-24	12-36

[a] The high figure allows for the restart of production in 1989-90.

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The relatively close contact between French and Chinese military officials since the late 1960s, the similarities between Chinese and French SLBMs, and between Chinese and French solid-propellant production and test facilities have convinced many analysts that French manufacturers provided direct assistance to the Chinese SLBM program. Others point out, however, that critical US and French technology has been available in Western journals, which the Chinese have mined assiduously for many years. We have no firm evidence that the French helped the Chinese develop SLBMs or other missiles.

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China could have produced many more solid-propellant missiles, including SLBMs, than we account for in our estimates of current and future missile force size (see table 2). We believe, however, that only a small fraction of this potential capacity will be used to produce SLBMs. The Chinese will also produce other solid-propellant missiles that are now being developed for deployment on land. And, as with related military industries, excess production is almost certainly intended to overcome inefficient production methods and disperse key manufacturing plants to decrease their vulnerability to attack.

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Appendix B

The Xia SSBN

The Xia SSBN has a single pressurized-water reactor and a raised turtleback. Its double-hull construction and electronics are similar to those of early Soviet SSBNs. [redacted]

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The development of China's SSBN has been largely an indigenous effort. We believe China received plans and parts for the Golf SSB from the Soviet Union in the late 1950s and may have been privy to plans for the November SSN, Moscow's first nuclear-powered submarine. [redacted]

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Table 3
Characteristics of Early Generation SSBNs

	Chinese Xia	US La Fayette	Soviet Yankee I	French Le Redoutable	UK Resolution
Initial operational capability	1986-87	1963	1968	1967	1967
Reactor	One pressurized-water reactor (PWR)	One PWR	One PWR	One PWR	One PWR
Hull	Double	Single	Double	Single	Single
Submerged displacement (*tons*)	6,500	8,250	10,800	9,000	8,400
Length (*meters*)	120	129.5	131	128	129.5
Speed (*knots*)	20-24	30	27	25	25
Number of missiles	12	16	3	16	16
SLBM range (*kilometers*)	2,400	4,600 [a]	2,700	3,200	4,600

[a] The La Fayette was originally equipped with a 2,800-km-range missile.

[redacted]

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Appendix C

The Han SSN

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China has apparently resolved problems that plagued the first Han-class nuclear attack submarine and has probably resumed construction on at least one, possibly two, additional Han submarines. China has built three Han SSNs—pennant numbers 401, 402, and 403:

- Han 401 suffered a major breakdown in 1980-81

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This suggests that the cause of 401's breakdown, possibly nuclear reactor or propulsion problems, has been at least partially resolved.

- Han 402 has been operational since April 1981. It was shown to US Navy Secretary Lehman during his August 1984 visit to China.

- Han 403 was launched in November 1983 and began sea trials after only 11 months' fitting out.

This compares favorably with Han 402's three-year and the Xia's 20-month fitting-out times.

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This

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submarine could be operational by March 1985.

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China's Han nuclear submarine has a rectangular sail mounted forward on the boat. The Han's blunt bow is characteristically Soviet in design, but the overall profile is strikingly Western.

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The Han is double hulled and probably has a propulsion plant similar to Soviet nuclear submarines. We believe that the electronics on the Han are similar to early Soviet systems.

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US defense attache reporting indicates that the Han apparently lacks most of the electronic equipment found on more advanced nuclear submarines. This reflects a probable lack of sophistication of the Chinese SSN, which can severely weaken its mission effectiveness.

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Table 4
Characteristics of Early Generation SSNs

	Chinese Han	US SSN-637	Soviet Victor II	French SNA-72	UK Swiftsure
Initial operational capability	1971	1967	1965	1982	1973
Reactor	One pressurized-water reactor (PWR)	One PWR	One PWR	One PWR	One PWR
Hull	Double	Single	Double	Single	Single
Submerged displacement (*tons*)	5,500	4,700	5,200	2,700	4,500
Length (*meters*)	96	89	94	72	83
Speed (*knots*)	20-24	30+	32	26	30+

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